

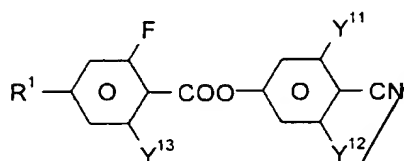
Patent Claims

Sup
A.1
5

1. An electro-optical liquid-crystal display comprising a realignment layer, for realigning liquid crystals, and a liquid-crystalline medium of positive dielectric anisotropy,

wherein said medium comprises one or more compounds of formula I

10



wherein

15

R¹ is H, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, alkenyloxy having 2 to 7 carbon atoms or alkoxyalkyl having 2 to 7 carbon atoms, and

20

Y¹¹, Y¹² and Y¹³ are each, independently of one another, H or F; and

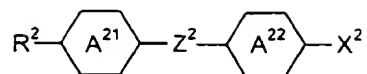
25

wherein when an electric voltage is applied to said display an electric field is generated which has a component parallel to the liquid-crystal layer for realignment of the liquid crystals.

30

Sup
B.2

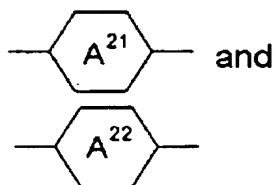
2. A liquid-crystal display according to Claim 1, wherein said medium comprises one or more compounds of formula II.



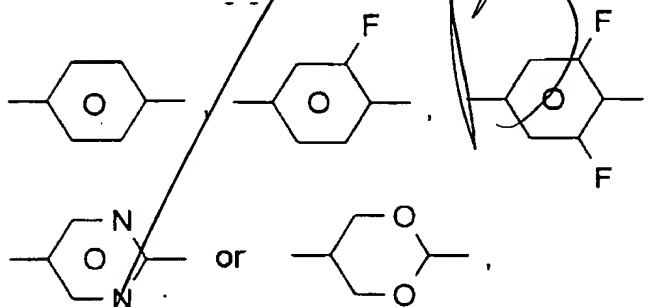
II

wherein

5 R^2 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
10 or alkoxyalkyl having 2 to 7 carbon
atoms,

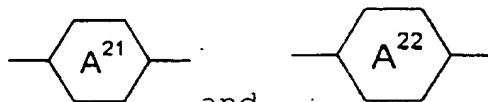


are each, independently of one another,



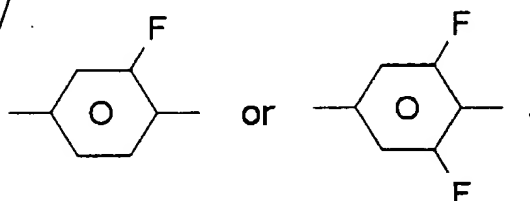
and

at least one of



and

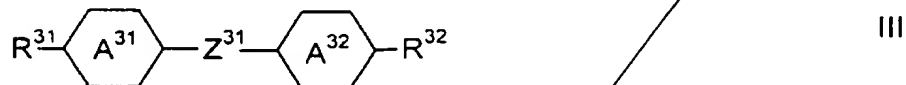
is



20 X^2 is F, Cl or CN; and

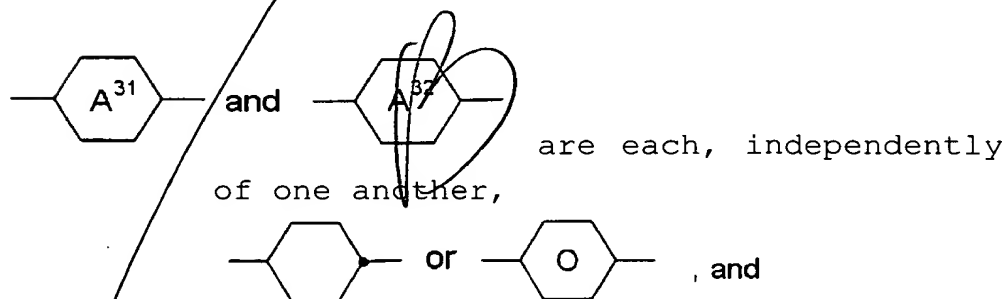
Z^2 is $-\text{CH}_2\text{CH}_2-$, $-\text{COO}-$, $-\text{CF}_2\text{O}-$ or a single bond.

- 5 3. A liquid-crystal display according Claim 1, wherein said medium comprises at least one compound of formula III



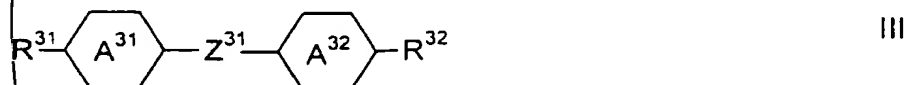
10 wherein

R^{31} and R^{32} are each, independently of one another, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, alkenyloxy having 2 to 7 carbon atoms or alkoxyalkyl having 2 to 7 carbon atoms,



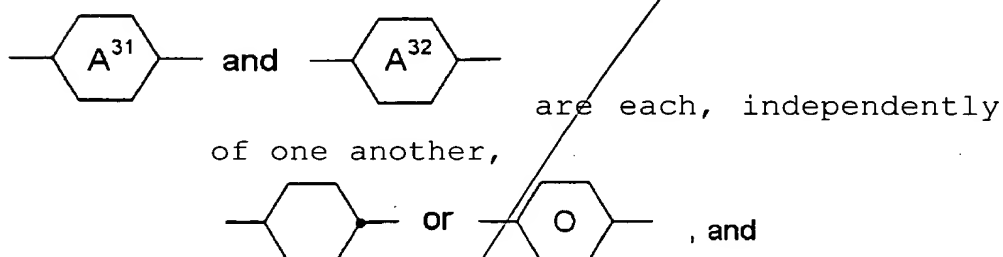
25 Z^{31} is $-\text{CH}=\text{CH}-$, $-\text{COO}-$, $-\text{CH}_2\text{CH}_2-$ or a single bond.

4. A liquid-crystal display according Claim 2, wherein said medium comprises at least one compound of formula III



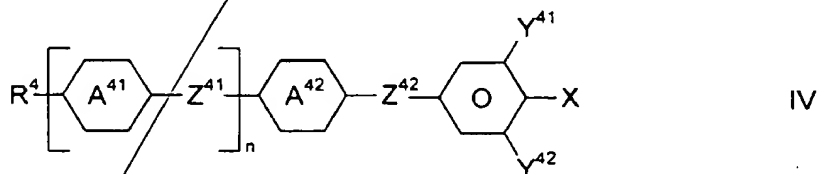
wherein

R^{31} and R^{32} are each, independently of one another,
alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
or alkoxyalkyl having 2 to 7 carbon
atoms,



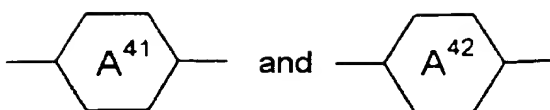
Z^{31} is $-\text{CH}=\text{CH}-$, $-\text{COO}-$, $-\text{CH}_2\text{CH}_2-$ or a single
bond.

5. A liquid-crystal display according Claim 1,
wherein said medium comprises at least one
compound of formula IV

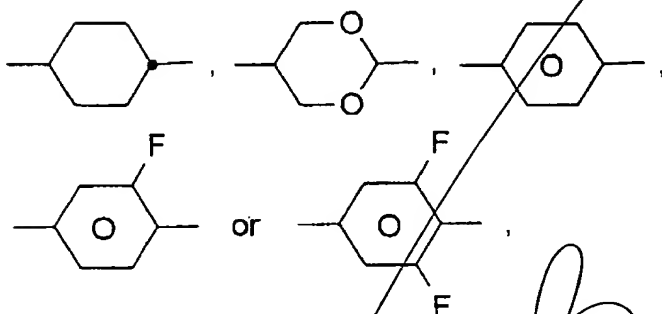


wherein

R^4 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
or alkoxyalkyl having 2 to 7 carbon
atoms,



5 are each,
independently of one another,



10 ,
 Z^{41} and Z^{42} are each, independently of one another,
-CF₂O-, -COO-, -CH₂CH₂- or a single
bond,

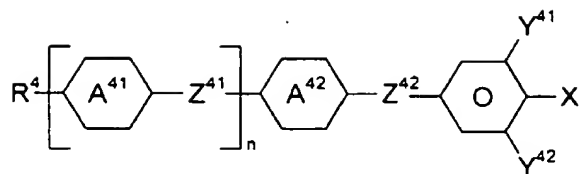
15 n is 0 or 1,

X is OCF₃, OCF₂H or F,

20 and

Y^{41} and Y^{42} are each, independently of one another,
H or F.

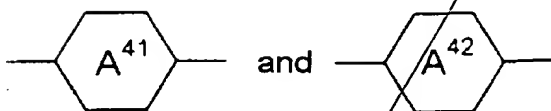
6. 25 A liquid-crystal display according Claim 2,
wherein said medium comprises at least one
compound of formula IV



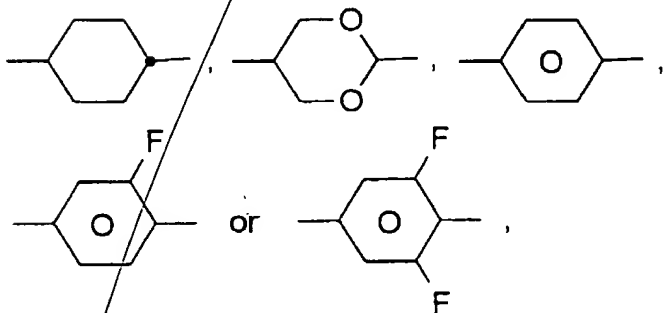
IV

wherein

5 R^4 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
10 or alkoxyalkyl having 2 to 7 carbon atoms,



15 are each,
independently of one another,



20 Z^{41} and Z^{42} are each, independently of one another,
-CF₂O-, -COO-, -CH₂CH₂- or a single
bond,

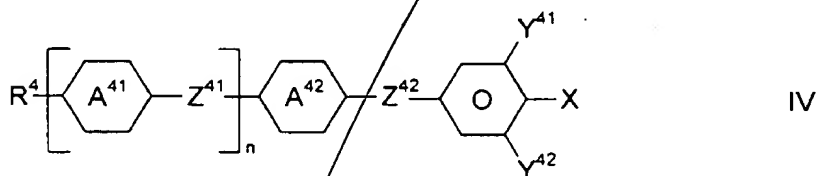
25 n is 0 or 1,

X is OCF_3 , OCF_2H or F,

and

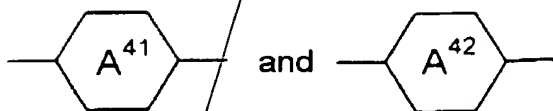
Y^{41} and Y^{42} are each, independently of one another,
H or F.

7. A liquid-crystal display according Claim 3,
wherein said medium comprises at least one
compound of formula IV

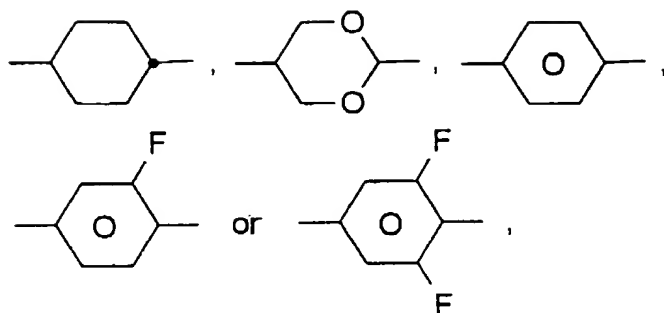


wherein

R^4 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms
or alkoxyalkyl having 2 to 7 carbon
atoms,



are each,
independently of one another,



5 Z^{41} and Z^{42} are each, independently of one another,
 $-\text{CF}_2\text{O}-$, $-\text{COO}-$, $-\text{CH}_2\text{CH}_2-$ or a single
bond,

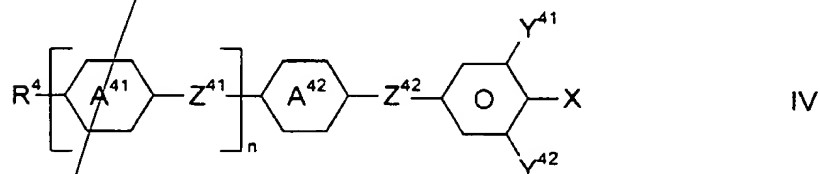
n is 0 or 1,

10 X is OCF_3 , OCF_2H or F ,

and

15 Y^{41} and Y^{42} are each, independently of one another,
 H or F .

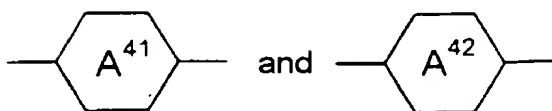
8. A liquid-crystal display according Claim 4,
wherein said medium comprises at least one
compound of formula IV



wherein

25 R^4 is alkyl having 1 to 7 carbon atoms,
alkoxy having 1 to 7 carbon atoms,
alkenyl having 2 to 7 carbon atoms,
alkenyloxy having 2 to 7 carbon atoms

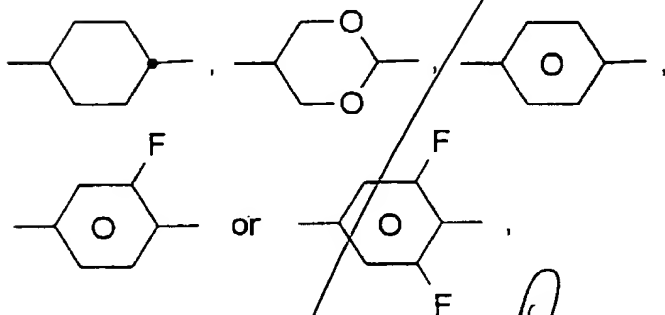
or alkoxyalkyl having 2 to 7 carbon atoms,



5

are each,
independently of one another,

10



15

Z^{41} and Z^{42} are each, independently of one another,
-CF₂O-, -COO-, -CH₂CH₂- or a single bond,

n is 0 or 1,

20

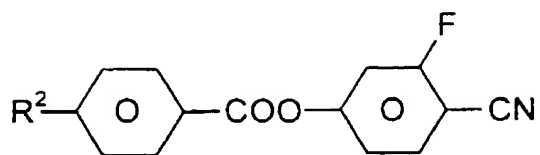
X is OCF₃, OCF₂H or F,

and

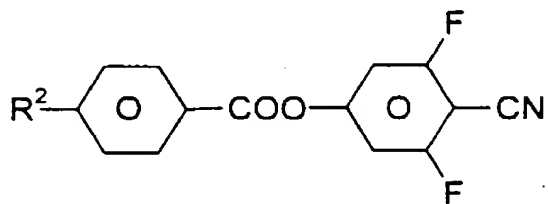
25

Y^{41} and Y^{42} are each, independently of one another,
H or F.

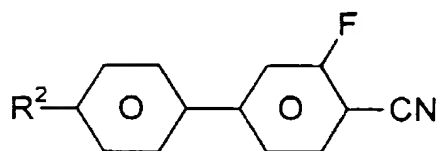
9. A liquid-crystal display according to Claim 2,
wherein medium comprises one or more compounds of
formulae IIa to IIg



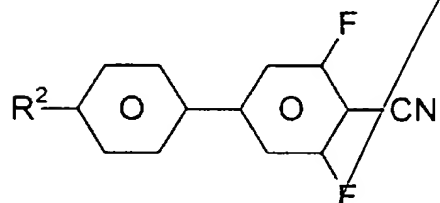
IIa



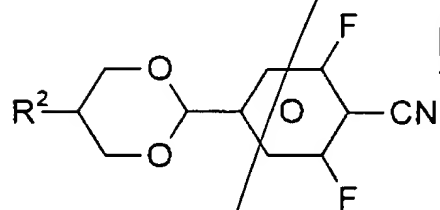
IIb



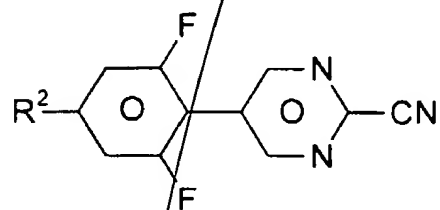
IIc



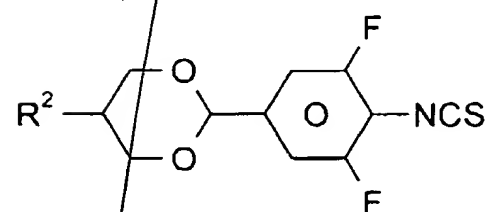
IId



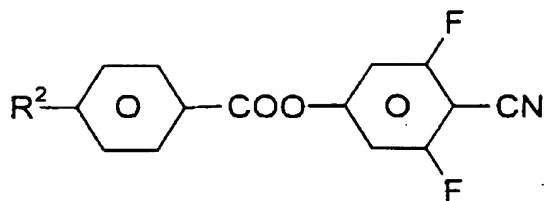
IIf



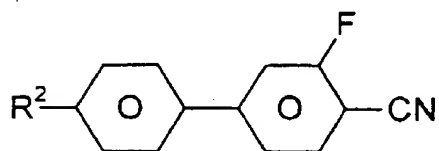
IIg



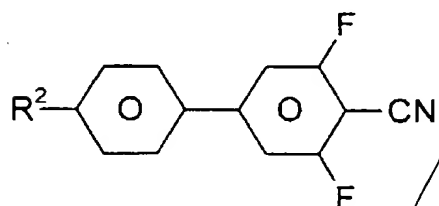
IIg



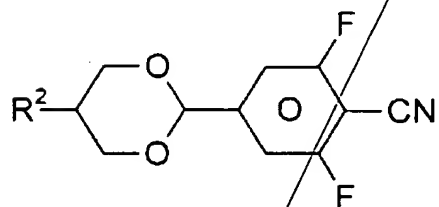
IIb



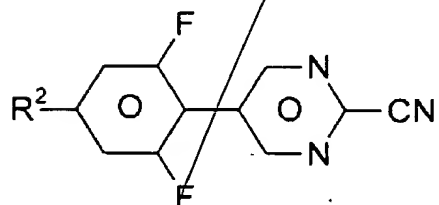
IIc



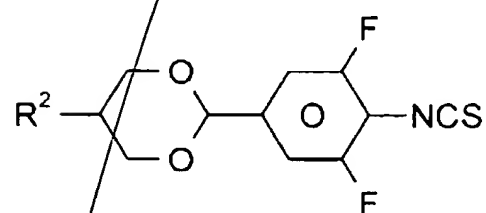
IIId



IIe

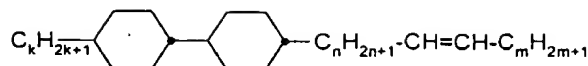


IIIf

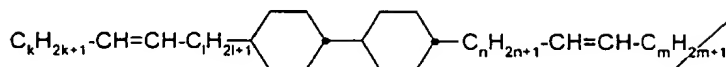


IIg

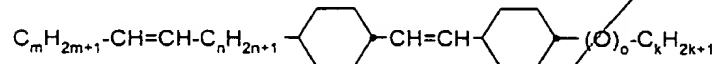
- 5 11. A liquid-crystal display according Claim 3, wherein said medium comprises one or more compounds of formulae IIIa to IIIc



IIIa



IIIb



IIIc

wherein

5

k is 1, 2, 3, 4 or 5,

m and n are each 0, 1, 2 or 3,

10

m + n is ≤ 5 , and

o is 0 or 1.

12. A liquid-crystal display according to Claim 8,
wherein said medium comprises

15

- 1 to 35% of one or more compounds of the formula I,

20

- 3 to 30% of one or more compounds of the formula II,

- 3 to 45% of one or more compounds of the formula III,

25

and

- 5 to 60% by weight of at least one compound of the formula IV.

30

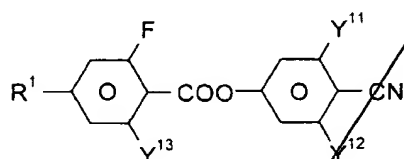
13. A liquid-crystal display according to Claim 1, wherein pixels of the display are addressed by means of an active matrix.

5
Sub
A2

14. A liquid-crystalline medium of positive dielectric anisotropy comprising at least two liquid-crystal compounds

wherein at least one of said compounds is of formula I

10



wherein

15

R¹ is H, alkyl having 1 to 7 carbon atoms, alkoxy having 1 to 7 carbon atoms, alkenyl having 2 to 7 carbon atoms, alkenyloxy having 2 to 7 carbon atoms or alkoxyalkyl having 2 to 7 carbon atoms, and

20

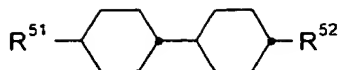
Y¹¹, Y¹² and Y¹³ are each, independently of one another, H or F.

25

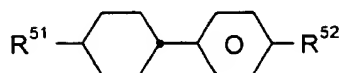
15. In a method of generating an electro-optical effect using a liquid-crystal display, the improvement wherein a display according to claim 1 is used to generate said effect.

30

16. A liquid-crystal display according to claim 1, wherein said medium additionally comprises one or more compounds of formulae Va and Vb



Va

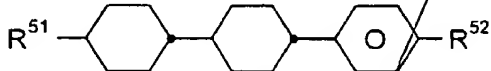


Vb

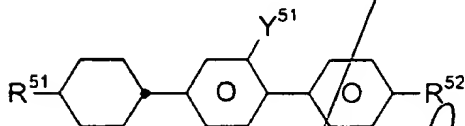
in which R^{51} and R^{52} are each, independently of one another, alkyl or alkoxy having 1 to 7 carbon atoms or alkenyl, alkenyloxy or alkoxyalkyl having 2 to 7 carbon atoms,

and/or

one or more compounds of formulae Vc and Vd



Vc



Vd

in which

R^{51} and R^{52} independently of one another, are as defined above, and Y^{51} is H or F.

17. A liquid-crystal display according to Claim 8, wherein said medium comprises

- 2 to 30% of one or more compounds of the formula I,
- 5 to 25% of one or more compounds of the formula II,
- 5 to 40% of one or more compounds of the formula III,

and

5 - 5 to 50% by weight of at least one compound of
 the formula IV.

18. A liquid crystal display according to claim 1,
 wherein said medium has a birefringence of <0.12 ,
 a flow viscosity at 20° of $<30 \text{ mm}^2 \cdot \text{s}^{-1}$, a
10 resistivity at 20°C of 5×10^{10} to $5 \times 10^{13} \Omega \cdot \text{cm}$,
 a rotational viscosity at 20°C of $<130 \text{ mPa} \cdot \text{s}$, and
 a clearing point above 60°C .

19. A liquid-crystal display according to claim 1,
15 wherein said medium has a birefringence of 0.05 -
 0.11 .

20. A liquid-crystal display according to claim 1,
 wherein said medium has a flow viscosity at 20°C of
20 15 - $25 \text{ mm}^2 \cdot \text{s}^{-1}$.

21. A liquid-crystal display according to claim 1,
 wherein said medium has a resistivity at 20°C of 5
 $\times 10^{11}$ to $5 \times 10^{12} \Omega \cdot \text{cm}$.

22. A liquid-crystal display according to claim 1,
 wherein said medium has a rotational viscosity at
25 20°C of 70 - $110 \text{ mPa} \cdot \text{s}$.

30 23. A liquid-crystal display according to claim 1,
 wherein said medium exhibits a storage stability
 of at least 1000 hours at -30°C .

Add
C2 A3